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225. Proposed by H. M. ARMSTRONG, Cooch's Bridge, Delaware.

If  $a = ax + cy + bz \dots\dots (1)$ ,  $\beta = cx + by + az \dots\dots (2)$ ,  $\gamma = bx + ay + cz \dots\dots (3)$ , show that  $a^3 + \beta^3 + \gamma^3 - 3a\beta\gamma = (a^3 + b^3 + c^3 - 3abc)(x^3 + y^3 + z^3 - 3xyz)$ .

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### GEOMETRY.

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248. Proposed by CHRISTIAN HORNING, Heidelberg University, Tiffin, Ohio.

Given  $AB, BC$  in a straight line, to produce it to  $D$  so that  $AD \cdot CD = BD^2$ .

249. Proposed by W. W. BEMAN, The University of Michigan.

Given the distances of a point in the plane of a square from three of its vertices, to find the side of the square.

250. Proposed by W. W. BEMAN, The University of Michigan.

Given the distances of a point in the plane of an equilateral triangle from the vertices; to find the side of triangle. [Perkins' *Geometry*, Olney's *Geometry*.]

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### CALCULUS.

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189. Proposed by J. E. SANDERS, Hackney, Ohio.

Solve  $d^2y/dx^2 = -\beta^2(p+y)$ ,  $p$  and  $\beta$  being constants. The initial conditions are  $y=0$  for  $x=0$ ,  $l$ ;  $dy/dx=0$  for  $x=l/2$ . [Merriman's *Mechanics*, 9th Ed., 1903, §62.]

190. Proposed by SAUL EPSTEIN, The University of Chicago, Chicago, Ill.

$$\int_0^\infty \frac{\sin x \cos \beta x}{x} dx, \int_0^\infty \frac{\sin x x \cos x}{x}.$$

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### MECHANICS.

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170. Proposed by M. E. GRÄBER, A. M., Heidelberg University, Tiffin, Ohio.

Prove that the moment of inertia of an ogival head rotating about its geometrical axis is  $\frac{\pi w}{g} \int_0^{R/(4n-1)} y^4 dx$ , where  $w$  is the weight in pounds of a cubic foot of material,  $R$  the radius of the base of the ogive, and  $n$  the diameter of projectile.

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### DIOPHANTINE ANALYSIS.

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123. Proposed by L. E. DICKSON, Ph. D., The University of Chicago.

Of two numbers  $a_i b_i c_i d_i e_i$  ( $i=1, 2$ ) it is given that their 10 digits  $a_1, \dots, e_2$  form a permutation of 0, 1, ..., 9, and that the sum of the two is  $x8951$ . Give an immediate evaluation of  $x$ ; also list the possible pairs  $a_1, a_2; \dots; e_1, e_2$ .